ISSN: 2229-6948(ONLINE)
DOI: 10.21917/ijct.2019.0303

OPTIMIZED COOPERATIVE QOS ENHANCED DISTRIBUTED MULTIPATH ROUTING PROTOCOL

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Abstract
The link failure is considered in this paper in order to guarantee reliable and continuous transmission of data. And to ensure that cooperative routing is done faster response and effective packet transmission. Cooperative communications are the most recent fields of research; they combine wireless channels' link quality and broadcasting nature. So communication in ad hoc mobile networks only works properly if the participating nodes work together in routing and transmission. A flow is divided into batches of data packets. When they leave the source node every packet in the same batch has the same forwarder list. The underlying routing protocol used in this work is Proactive Source Routing (PSR), which provides each node with all other nodes on the network. The forwarder list therefore contains the identity of the path nodes from the source node to the location. Once packets progress through the network, forwarding nodes can amend the forwarder list when any changes in the network topology have been observed. In addition, some other nodes not listed as transmitting data may also be transmitted, which is called as small-scale retransmission.

Keywords:
Link-Quality, QOS, Proactive Source Routing, Multipath Routing Protocol

1. INTRODUCTION

The devices communicate with the associated receiver node individually in traditional wireless communication systems, and vice versa. However, data transmitted from a source node can often not only be overheard by the recipient node but also by its neighboring nodes. Signals received from the neighboring nodes are traditionally treated as interference and numerous techniques to ease its effect have been developed. In fact, however, such interference contains useful information for receiving signal. Thus, such information is transmitted through a surrounding node(s) known as relays to the destination in cooperative communications in order to enhance reception performance at the destination. A cooperative system is a communication system that uses relay nodes in the network to improve the performance of transmission. There are a huge number of different types of cooperative systems due to the different ways in which relays can be deployed and used [1]-[5].

Wireless networks allow an ever-growing range of applications. The quality of service and scalability are limited by fundamental restrictions. These include a limited spectrum of radio-frequency, signals, such as fading and shadowing, resulting in areas of low coverage and a small mobile device shape factor with reduced energy and antenna diversity. Recently it has become more crucial to improve the robustness and performance of cellular systems due to increasing demand for mobile services such as Mobile Cloud Computing and video streaming. Many technologies have been proposed or adopted, such as dynamic power monitoring, adaptive coding and modulation, a smart antenna, but the gain in cooperation has still been fully exploited. One of the solutions used by operators to improve spectrum efficiency is to install additional base stations, but it is ineffective and expensive [6] [7].

There has been a growing interest in recent years to deploy a purely distributed number of micro-sensors for data collection and processing. Sensors are expected to be inexpensive and large-scale in harsh environments, implying a usual unattended operation of sensors. Sensor networks can also often suffer high failure rates: node connectivity can be lost due to environmental noise and barriers; battery depletion, changes to environment or malicious destruction can cause nodes to die. Reliable and energy-efficient data supply in these environments is vital since sensor nodes operate with low battery power and wireless channels that are prone to errors [8].

These sensor network features make it difficult to design a routing protocol. A great deal of research focuses on extending the lifetime of the network through the use of energy efficiency, reliability and low cost sensor design to deal with those issues. These objectives are the design goals [9] [10].

In this study a new communication model was explored, which combines multiple mobile nodes and the base stations. In this work, a number of cooperating mobile nodes equipped with multiple radio interfaces exploited communication strategies that exploit channel diversity. Diversity and co-operation have been studied for many years as general mechanisms for improving the robustness and efficiency of wireless communications systems, but little research has been done on wireless systems with multiple air interfaces that consider the unique features of each interface. The increased integral hardware, faster computing and high user density make it possible and even necessary to cooperate between nearby devices, given the increased demand for bandwidth.

2. LITERATURE REVIEW

The authors in [11] have studied the joint problem of wireless network transmission and routing. The network nodes are supposed to have one omnidirectional antenna, and several nodes can coordinate their transmissions to achieve transmission diversity. The problem is formulated of finding the minimum energy route.

For both regular network topology and grid topology, asymptotic analysis results are obtained for lower limits on the resulting power savings. Energy savings of 39 percent can be achieved for regular line topology. Energy savings of 56% can be achieved for a grid topology. The development of heuristics of polynomial complexity for arbitrary networks results in an average energy saving of 30% - 50% on simulations.

The authors in [12] examined key biologically inspired mechanisms and related solutions for wireless sensor networks including Ant-based and genetic approaches. In addition, this paper's main contributions are as follows. We present the mathematical theory of biological computations in sensor grids; we also provide an overview of several emerging research directions within the new biologically computational framework in sensor network by diffusing different biological computer modes using Ant-base and genetic approaches.

The authors in [14] suggested a reliable Energy Effectively Routing (REER) which, based on geographical information, takes advantage from high node density and uses a number of cooperative nodes to collectively supply data without dependent data. In the trial, reference nodes were selected between the source and the sink. Multiple cooperative nodes (CNs) are selected for each RN. Cooperative routing is reliable: each hop maintains several CNs, among which everyone can receive upstream data for the successful data transmission. The distance between two adjacent RN is the control buckle for robustness swap, total energy costs and latency end-to-end [14].

Therefore, only local knowledge is needed to cooperate on every hop. Multiple nodes are cooperating with lower coordination levels. Our strong, cross-layer design is based on the IEEE 802.11 MAC protocol and the MAC layer are anchored to our robust collaboration routing. When a node moves away, the resulting path breakage is permanent. The interference and deterioration may result from temporary path failure. Robust routing is eliminated as a distributed approach from significant road maintenance, update and overhead repair control. Only light overhead happens during robust routing. Cooperation between nearby nodes also increases energy efficiency, given that routing connections are preferred more reliable and stable. The selection of reliable connections reduces the potential for transmission, reducing energy and reducing late transmission [15].

Maalej et al. [17] uses a technique to enhance learning modelling, to optimize an RSSI-based collaborative communication protocol, and an energy efficiency-based competitive node consumption, i.e. an energy and service quality cooperation communication protocol.

Rani et al. [16] investigates a reduction in total transmission time and energy consumption of wireless sensor networks using MS data aggregation. In numerous circumstances as in large deployments and high densities, the new algorithm handles the wireless sensor network. One of the main purposes is to collect information from inaccessible areas by using area factorisation in clusters and designation of cluster heads in individual sub-areas. Every node was served by co-ordination and co-operation with the local nodes through local cluster relays. The routing is based on the new transmission algorithm, the pre-defined route. By using cluster coordinators for intercluster communication and relay nodes, transmission distance is reduced to a minimum.

Chai et al. [2017] proposed the hybrid routing protocol (CHRP) cooperative load-aware cooperative. LA-CHRP is suitable not only to cover the special features of routers and customers, but also for routing loads. For mesh routers and customers respectively, different load levels are set. Customer-oriented traffic and gateway are handled differently. For the former, mesh routers can be used more reasonably by taking into account load levels in the cooperative mechanism. The latter is used to select mesh routers in priority with node-aware routing metric and for mesh-clients also load status is considered. If energy is sufficient, customers with a lower load are selected to carry packages. The simulation results show that LA-CHRP in hybrid WMNs can achieve high performance with a low latency and packet loss rate.

The authors in [18] proposed the cooperative Middle Access Control (MAC) protocol to UCMAC, which is based primarily on cooperative communication, for underwater wireless sensor networks. In UCMAC a source identifies cooperators and lists the co-operators at its destination, while delineating its vicinity. The destination then asks for the transfer to the co-operators in the close-first way for the incorrect receipt of data packets. A designated cooperator transmits from the source or from other cooperators the buffered data packet it has successfully overheard. A signaling procedure and the different waiting times of the nodes are designed to carefully address the overheads resulting from cooperation. This document evaluates UCMAC in terms of system performance, latency, Packet Single Hop Ratio (PDR), and energy efficiency through computer simulation. The findings show that UCMAC does better, including MACA-U and CD-MACA, than existing systems.

The QoE-based distributed routing method is presented in [13]. AD3 is highlighted as one of the most efficient amongst distributed cooperative optimization schemes due to its rapid convergence. This paper covers the original problem into the factor chart and optimizes the number of messages exchanged, proposes a partially distributed routing scheme based on OLSR and AD3, and proposes a distributed decoder algorithm to find a workable solution. The comprehensive results of the simulation confirm the benefits of the proposed scheme.

3. ENERGY-AWARE QOS ROUTING

We suggest a multi-path routing protocol hybrid QoS for MANET in this work. This technique proactively performs topology discovery and reactivates route discovery. Every node learns in the topology discovery phase the battery power, queue length and residual bandwidth of any other node and is stored in the TIT or topology information table. The topology is found by exchanging the TIT between the nodes. The source will check the TIT and calculate the link metric using the TIT data to transfer the data packet to the destination. The source chooses the minimal LM nodes and begins the transfer of the packet through the selected node in 2-hop.

The Dijkstra algorithm for multiple paths with nodes having a minimum connection metric is used to transmit the data. If an intermediate node does not recognize the next 2-hop TIT to a destination information, then this message propagates route request (RREQ) to all nodes according to any reactive multi-path routing protocol such as AOMDV. Then route response messages (RREP) are forwarded to the source along the reverse routes to set the best route to the destination. Whenever the new route is found, the source updates its TIT.

3.1 NEIGHBORS SELECTION

In the proposed protocols, each node in the transmission range is kept. The message is sent through the network. This message includes the source node, destination node, location and the depth of the source node.

The node received calculates how far from the source to the destination node is the Euclidean distance. The protocols proposed help to transmit the optimum neighbor as required.

$$Distance(i,j) \leq TransmissionRange(R_t) \quad (1)$$

$$Depth_i > Depth_j \quad (2)$$

The existing transmitter can be found in this sensor node depth, and for additional bit error rate and over-communication removal in the proposed protocols, information on higher depth nodes is not necessary.

The proposed routing protocol at this stage will locate the neighbors as quickly as possible from the neighboring table. With minimum overhead energies, the proposed routing protocol offers the opportunity to find the fastest route.

Once information from the current node is supplied by the next hop neighbour, the proposed routing protocol transmits data packets to avoid empty regions. The shortest path is achieved using a protocol based on the Dijkstra algorithm. The best way to communicate is chosen.

The proposed routing protocol will also transmit data packets after the information from the next hop neighbor to the current node has been secured to avoid empty regions. The routing protocol provides the shortest route from all paths to opportunistic routes. The route is selected with minimum bit rate error and less surface distance.

Following two conditions must be true for transmission of data packet from a node.

- A sensor or relay node must be used for linear transmission
- There must be a cross node for binary tree.

If the node is a simple sensor node, the signal will be unlocked. The formation of a binary tree otherwise starts with a source node that acts as the root and the leaves of the next nodes. In each parent node there are almost two child nodes. Cross-nodes in the proposed protocols are the main features used in tree generation.

If a node sends or transfers a packet, the node selects its next sponsor and its neighbors' forwarding candidates. The forwarder list includes the following hop and the candidate list. The flow diagram below indicates the way the forwarder list is selected and given priority. The list of candidates will be hop-updated and attached to the package header. As forwarding candidates, only the nodes in the candidate list will act.

Here *ND* indicates the destination node, base specifies the distance between current node and *ND*. ND_n specifies the distance between destination node *ND* and the set of *n* neighbour nodes. ND_n>base defines if distance between neighbour node and destination node is greater than distance between between current node and destination node then neighbour node will be added to the candidate list.

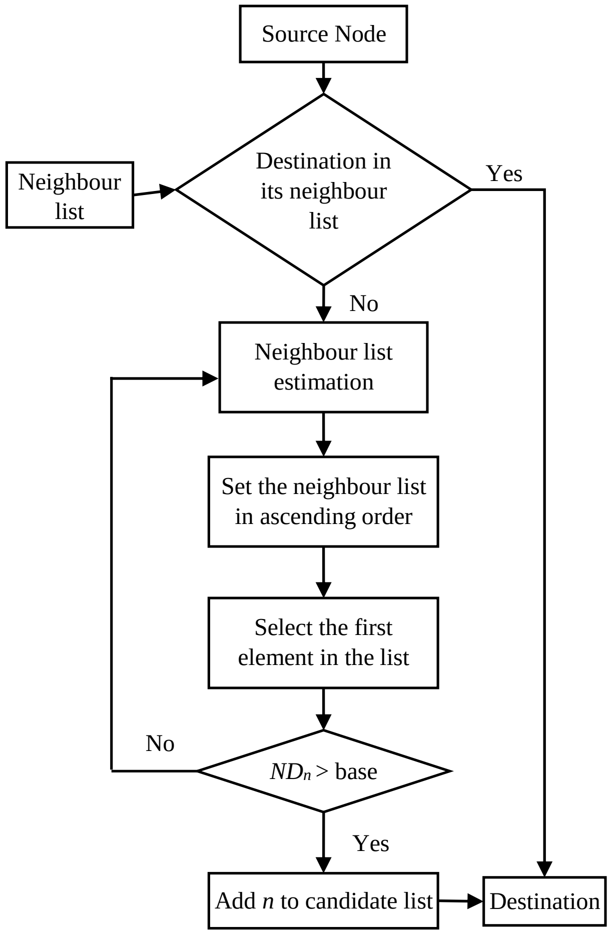

Fig.1. Flow diagram of selecting forwarding candidates

It is important that all candidate nodes after the packet has been sent somehow agree who the forwarding node is going to be. This is accomplished with recognitions (ACKs), which are sent directly after our packet is received. In the order in which the ACKs are shown in the packet header, the forwarding candidates send it. In addition to the ID of its sender, each ACK contains the ID of the successful recipient of highest priority known to the ACK sender. All candidates listen to all slots, so that this mechanic can delete duplicate transfers to a certain extent, before deciding whether a packet can be transmitted because the information, the referencing node, somehow rips out from the candidate sub network. This phase is pretty simple, since after all nodes not only have received the packet, they can decide easily whether they act as the forwarding node, but a large portion of recognitions. The packet is forwarded so the best known ACK-ID is not larger than (equal to) the identification of the node itself.

4. RESULTS AND DISCUSSION

In this section, complete research work performance measurement is conducted in the NS2 simulation environment together with current and proposed system performance metrics. Although the work currently in use is very low, the performance of the proposed system is improved by incorporating various new algorithms. The comparative evaluation is made between the QoS-Oriented Distributed Routing Protocol (QOD) and Enhanced QoD (EQoD) and MPIPRM and Cooperative and Optimized QoS

Distributed Multipath Routing Protocol (CDMRP). A comparison of works is carried out between the existing works. The Table.1 shows network settings installed during the experiments. These values can be varied and optimized for various applications. In Table.1 the time interval is used to shorten the time of observation testing in the current case of the study.

Table.1. Setting Values for Experiments

Description	Parameter	Unit	Value
Total number of nodes	N	Nodes	30
Number of clusters	C	Clusters	3
Time to recluster	$T_{recluster}$	Ms	30000
Sample time for sensing	T_{sample}	Ms	500
Time interval between two data transmission	T_{cycle}	Ms	5000
Time to receive data of CH	T_{DataRx}	Ms	500
Time to aggregate data at CH	$T_{Dataagg}$	Ms	50
Maximum time to keep radio on for sending	$T_{Radioon\_CH}$	Ms	600
Maximum time to keep radio on for sending	$T_{Radioon\_CM}$	Ms	100
Voltage threshold for dead node	ΔV_{th}	mV	100

4.1 ENERGY CONSUMPTION

Energy consumption is defined as the amount of energy consumed successfully by the entire network for data transfer. The evaluation of the QOD and MPIPRM approach offered by way of energy consumption is shown in Fig.2. It is possible to change the movement between 10s and 50s.

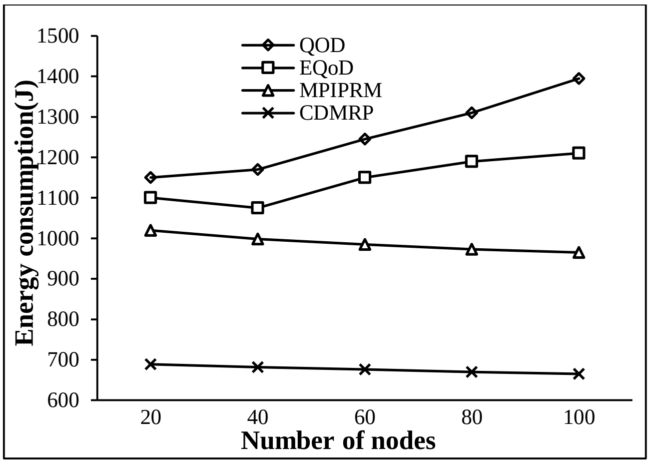

Fig.2. Number of nodes vs. Energy Consumption

4.2 PACKET DELIVERY RATIO

The ratio of data packets received to data packets forwarded. From Fig.3, we can observe that the packet delivery ratio compares existing and proposed systems. The number of nodes is indicated in the *x*-axis and the packet delivery relation value is indicated in the *y*-axis. Therefore, it shows that the proposed method is used to efficiently detect. We conclude from the result that the system proposed is superior in terms of performance.

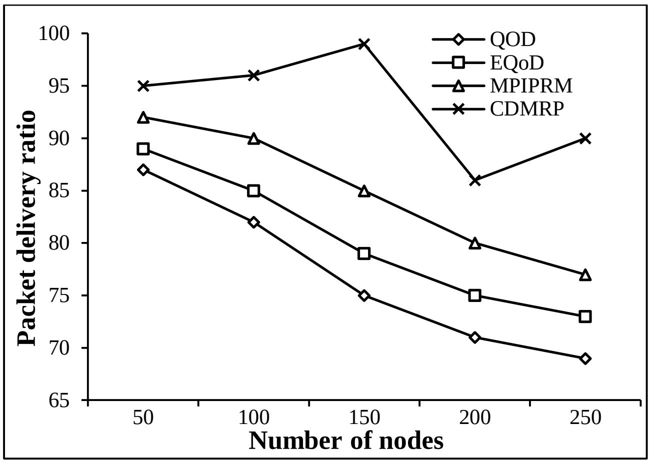

Fig.3. Packet delivery ratio comparison

4.3 THROUGHPUT

Network performance refers to the typical successful packet delivery ratio for a message channel. Network performance is measured in bits per second and the higher performance is the better.

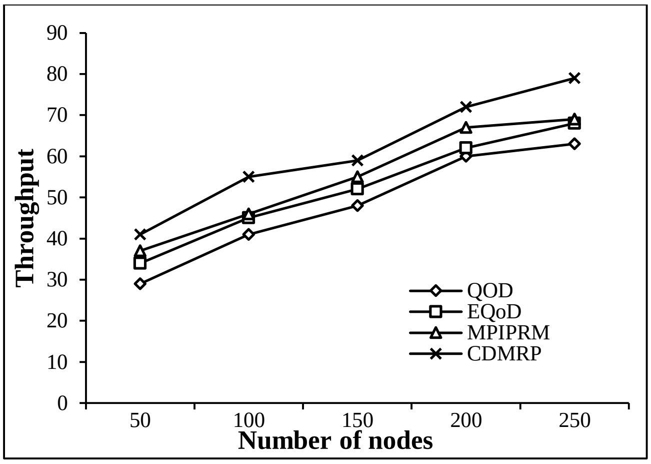

Fig.4. Throughput comparison

The Fig.4 shows a performance comparison in terms of throughput metric for the existing and proposed system. Comparisons between the existing and the proposed method are observed by calculating the number of nodes in *x* axis against the *y* axis throughput values. There is lower performance of the CDMRP method. There was an increased throughput value from the proposed CDMRP system. The proposed method shows that the detection is efficient and results show that the system proposed shows better performance than the existing methods.

4.4 END TO END DELAY

End-to-end delay indicates the amount of time it takes to transmit the packet over a network from source to destination. The transmission is usually caused by collision queuing and retransmission. Existing and proposed systems in terms of end-to-end delay metric are compared from Fig.5. The graph was drawn against the end-to-end values in the *y* axis with the number of *x*-axis nodes. The results showed that by using the CDMRP method, end-to-end delays are higher. Therefore, an efficient detection using the proposed method could be deduced and results conclude that the proposed system has a better performance.

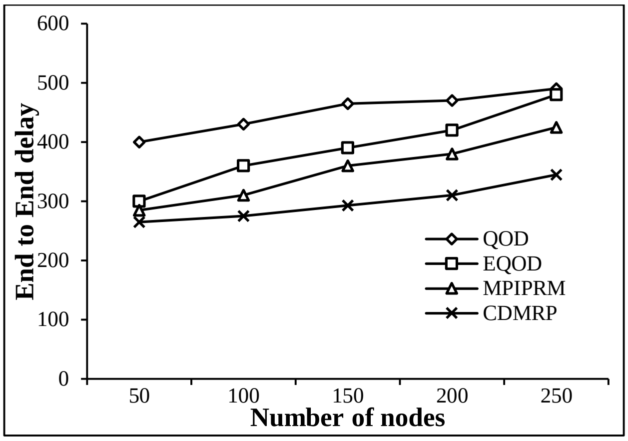

Fig.5. End to End Delay comparison

5. CONCLUSIONS

In this work, a connection failure is taken into account to ensure reliable and continuous transmission of data. And ensuring that cooperative routing is carried out with quickest response and successful packet transfer. It combines the quality of wireless connections and the broadcast nature of wireless networks. Communication in ad hoc mobile networks therefore only works properly when the participating nodes are involved in routing and redirecting. The results of the simulation show the efficiency and enhanced collaborative routing compared to existing methods. Comparing the current method, it is evident that the proposed method has increased its efficiency with regard to the increased package supply ratio, the increase in performance, the decreased energy consumption and the decreased delay in end-to-end.

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